



Efficient Multidimensional Polynomial Filtering for Nonlinear Digital Predistortion

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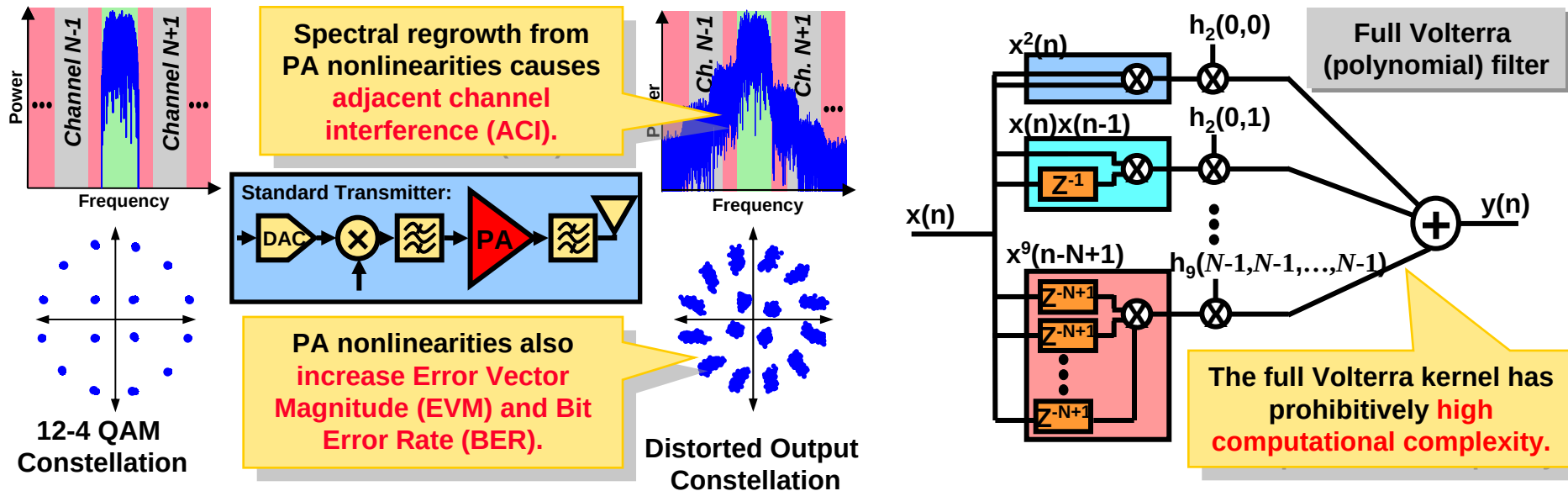
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Motivation

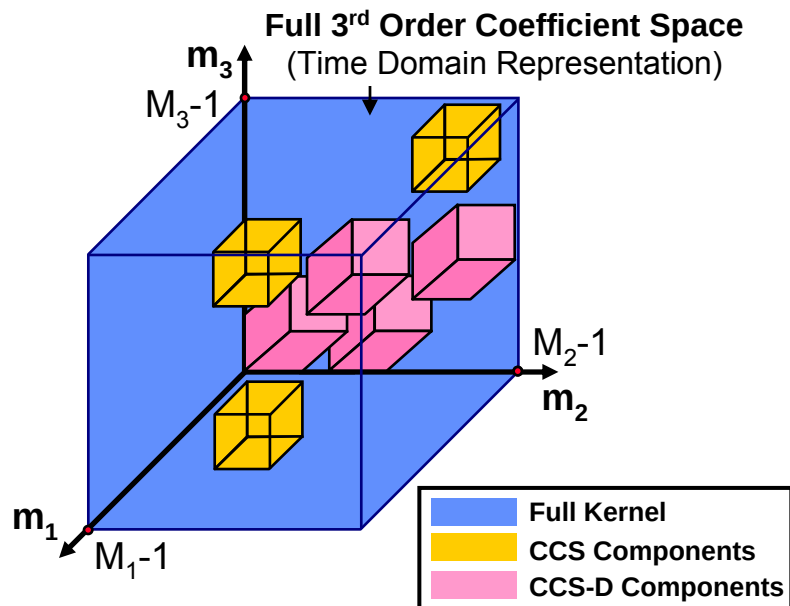


- The objective of Nonlinear Digital Predistortion (NDP) is to digitally alter the input to the PA to compensate for the distortions imparted by the device.
 - NDP is capable improving power efficiency while reducing ACI and BER.
- Computationally efficient memoryless NDP techniques are not sufficient for linearizing wideband PAs that impart significant memory effects.
- Not feasible to use a computationally complex polynomial predistorter to model/invert state dependent nonlinearities.
 - Most previous polynomial approaches consider 1D subkernels as building blocks for the full PD.
 - Multidimensional filters more easily address asymmetric and aliasing NL.

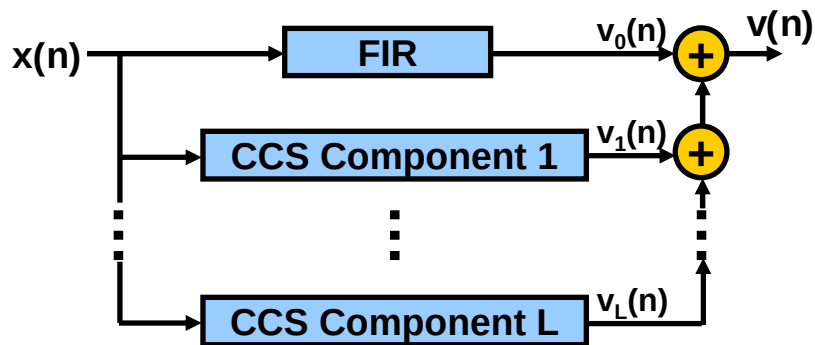
OBJECTIVE: Use small multidimensional filters to build a computationally efficient nonlinear digital predistorter.



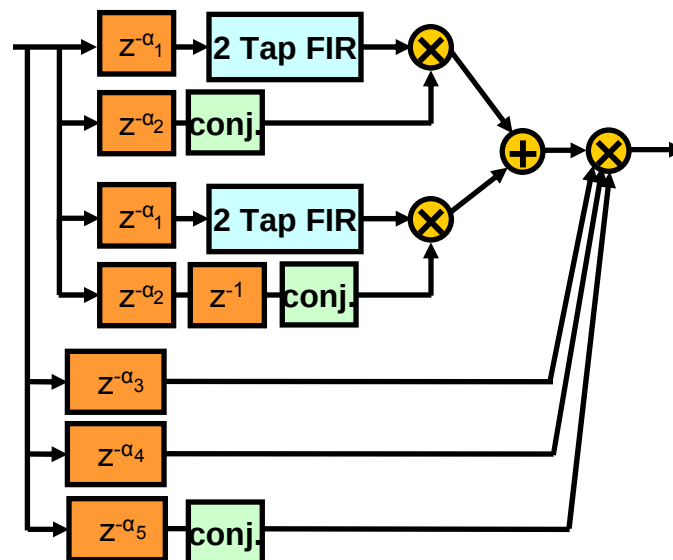
Methods



CCS Nonlinear Digital Predistorter:



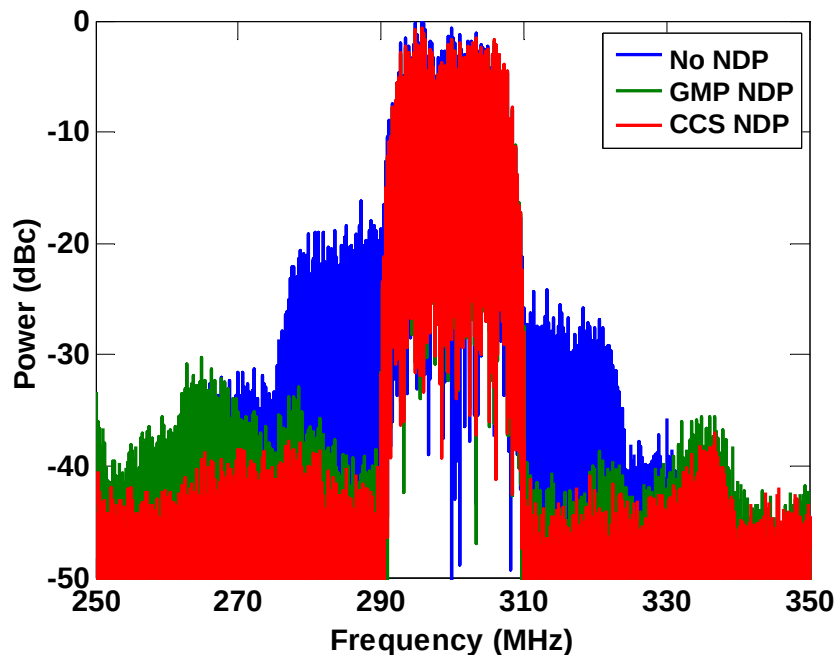
- Divide the full coefficient space into **cube coefficient subspaces (CCS)**,
 - i.e., small hypercubes/parallelepipeds (“diagonal” CCS-D) of arbitrary dimension.
- Model the inverse NL by greedily selecting only the CCS components that have the greatest impact on performance.
- CCS allows efficient adaptation in multiple dimensions starting with the first nonlinear component selected.
- CCS has an efficient hardware implementation.





Results

Measured Results using Q-Band Solid State PA:



Computational Complexity:

Architecture	Complex Mult. Per Sample	Complex Add. Per Sample	Op'ns Per Second (GOPS)
Generalized Memory Polynomial	156	144	147
2-D CCS/CCS-D	76	32	62

CCS NDP improves ACI by ~20 dB.

CCS reduces ACI by ~7 dB more than the state-of-the-art GMP with less than half as many operations per second.